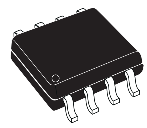
L9616

HIGH SPEED CAN BUS TRANSCEIVER

- L9616 MEETS ISO/DIS 11898 UP TO 1MEGABAUD
- TRANSMITTER
  - GENERATION OF DIFFERENTIAL OUTPUT SIGNALS
  - SHORT CIRCUIT PROTECTED FROM -5V TO 36V, DETECTION & SHUTDOWN
  - SLOPE CONTROL TO REDUCE RFI AND EMI
  - TWO STATES ADJUSTABLE SLOPE CONTROL (≤1MEGABAUD/≤250KBAUD)
- RECEIVER
  - DIFFERENZIAL INPUT WITH HIGH INTERFERENCE SUPPRESSION
  - COMMON MODE INPUT VOLTAGE RANGE (V_{COM}) FROM -2V TO V_S+3V
- ESD PROTECTION LEVEL UP TO 4kV
- PACKAGE: SO-8



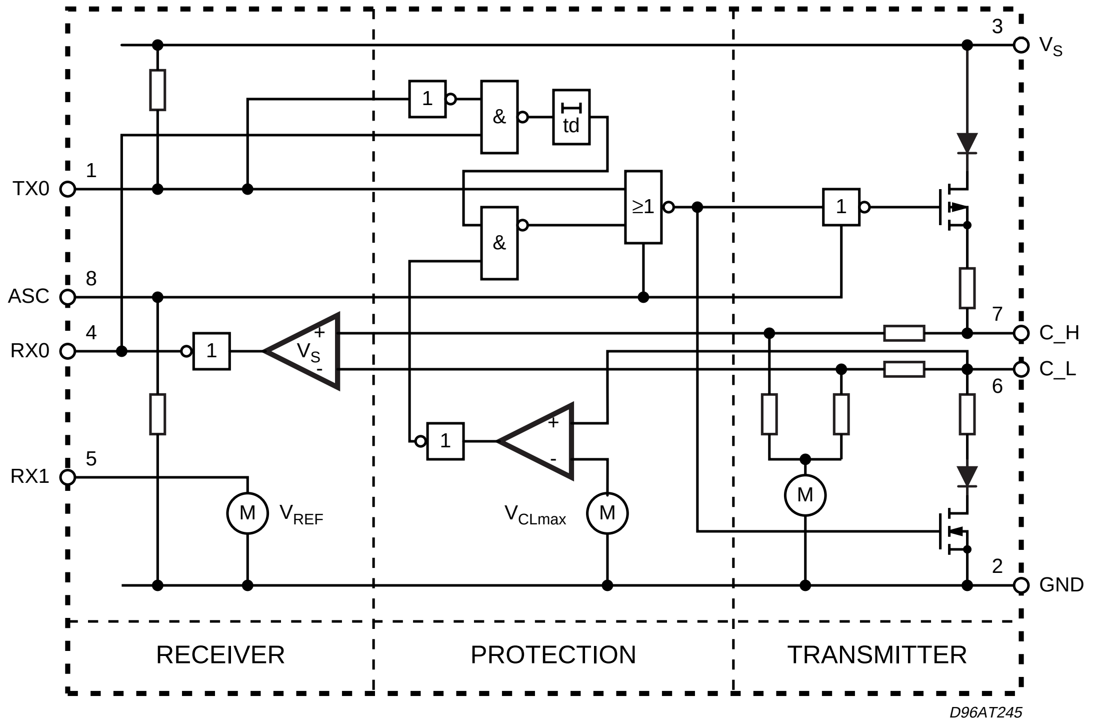
SO-8

ORDERING NUMBER: L9616D

DESCRIPTION

The L9616 is a bidirectional transceiver for signal conditioning and processing in connection with a CAN controller. Data rates of up to 1MEGABAUD are supported using either shielded or non-shielded pair of lines.

BLOCK DIAGRAM

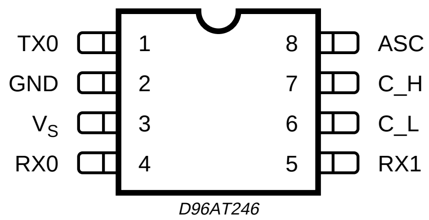


ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_S	Supply Voltage	-0.3 to 7	V
V_{C_H}, V_{C_L}	Bus Voltage at C_H, C_L (VS 0 to 5.5V)	-5 to 36	V
I_{C_H}, I_{C_L}	Off State Leakage Current at C_H, C_L (VS =0 to 5.5V, V_{C_H} = -5 to 36V, V_{C_L} = -5 to 36)	-3 to 5	mA
V_{DC}	DC Voltage at TXO, ASC (VS 0 to 5.5V)	GND -0.3 to V_S +0.3	V
I_{RXO}	Output Current at RXO (V_S 0 to 5.5V)	-0.3 to 1	mA
T_{stg}, T_J	Storage and Junction Temperature Range	-40 to 150	°C
T_{op}	Operating Temperature Range	-40 to 125	°C

All voltages, except bus voltage, are defined with respect to pin 2
Positive currents flow into the IC.

PIN CONNECTION



THERMAL DATA

Symbol	Parameter	Value	Unit

PIN FUNCTIONS

N.	Name	Function
1	TXO	Transmitter Input
2	GND	Ground
3	V_S	Supply Voltage
4	RXO	Receive Output
5	RX1	Reference Voltage
6	C_L	Low Side Bus Output
7	C_H	High Side Bus Output
8	ASC	Adjustable Slope Control

ELECTRICAL CHARACTERISTICS (T_{OP} = -40 to 125°C; V_S = 4.5 to 5.5V; Dominat: VTXO = GND; Recessive: VTXO = V_S; All voltages, except bus voltage, are defined with respect to pin 2. Positive currents flow into the IC unless otherwise specified.)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V_S	Supply Voltage		4.5	5	5.5	V
I_S	Supply Current	Dominant			80	mA
		Recessive			20	mA
TRANSMITTER SECTION (R_A = 60Ω between C_H and C_L)						
C_{TXO}	TXO Input Capacitance	0V < V_{TXO} < V_S		25		pF
V_{TXO}	TXO High Level Input Voltage		0.7 V_S		V_S	
	TXO Low Level Input Voltage		0		0.3 V_S	
I_{TXO}	TXO High Level Input Current	V_{TXO} = V_S	-2	0	2	µA
	TXO Low Level Input Current	V_{TXO} = GND	-275	0	-25	µA
C_{ASC}	ASC Input Capacitance	0V < V_{ASC} < V_S		25		pF
V_{ASC}	ASC Input Voltage for High Speed		0		0.1 V_S	
	ASC Input Voltage for Low Speed		0.9 V_S		VS	
I_{ASC}	ASC Input Current	V_{ASC} = V_S	25		275	µA
		V_{ASC} = 0V	-2	0	2	µA
V_{C_H}, V_{C_L}	Bus Voltage Recessive	Recessive	0.4 V_S	0.5 Vs	0.6 Vs	
I_{C_H}, I_{C_L}	Leakage Current Recessive	VC_L = V_{C_H} = -2 to 7V	-0.7		0.7	mA
		V_{C_L} = V_{C_H} = 1 to 4V	-0.3		0.3	mA
$R_{IN(C_H,\ C_L)}$	Input Resistence	Recessive	5		50	KΩ
$R_{Diff(C_H,\ C_L)}$	Differential Input Resistence	Recessive	10		100	KΩ
V_{Diff} = V_{C_H} - $V_{C_L)}$	Differential Output Voltage	Dominant, R_A	1.5		3	V
V_{Diff} = V_{C_H} - $V_{C_L)}$	Differential Output Voltage	Recessive	-500	0	50	mV
t_d	Short Circuit Detection Time C_H to C_L ; C_H to B	R_{CS} < 1Ω	1	5	10	µs
I_A	Supply Current in Case of Short Circuit, C_H to C_L, C_H to B (time = t_d)			150		mA
V_{C_Lmax}	Overvoltage Protection Threshold on C_L		7	8	10	V
RECEIVE SECTION						
V_{RXO}	RXO High Level Output Voltage	V_{Diff} < 0.5V; I_{RXO} = 0.3mA; V_{C_H} = -2 to 7V; V_{C_L} = -2 to 7V;	0.9 V_S		Vs	V
	RXO Low Level Output Voltage	V_{Diff} > 0.9V; I_{RXO} = 1mA; V_{C_H} = -2 to 7V; V_{C_L} = -2 to 7V;			0.5	V
V_S = V_{C_H} - V_{C_L}	Input Signal Threshold	V_{C_H} = -2 to 7V; V_{C_L} = -2 to 7V;	500	700	900	mV
V_{COM} = (V_{C_H} + V_{C_L})/2	Input Common Mode Voltage Range		-2		7	V
V_{HYS}	Differential Input Hysteresis			150		mV
REFERENCE OUTPUT						
V_{RX1}	Reference Voltage	I_{RX1} = 0	0.45 V_S	0.5 V_S	0.55 V_S	V
R_{RX1}	Output Resistance		2		9	KΩ

DINAMIC CHARACTERISTICS (C_A = 47pF between C_H and C_L; V_S = 5V; t_R < 5ns; C_{RXO} = 20pF between RXO and B; R_A = 60Ω between C_H and C_L)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
t_{OT}	Signal Delay TXO to C_H, C_L				50	ns
S_R	Differential Output Slew Rate (Transmitter)	V_{ASC} = 0V	20		50	V/µs
		V_{ASC} = V_S	5		20	V/µs
t_{OR}	Signal Delay C_H, C_L to R_{XO}	V_{ASC} = 0V			150	ns
t_{OTR}	Signal Delay T_{XO} to R_{XO}	V_{ASC} = 0V			300	ns

FUNCTIONAL DESCRIPTION

The L9616 is used as an interface between a CAN controller and the physical bus. The device provides transmitting capability to the CAN controller.

The transmitter outputs C_H and C_L are protected against short circuits and electrical transients which may occur in an automotive environment. In case of short circuit (C_H to C_L, C_H to B) the protection circuit recognizes this fault conditionand the transmitter output stages are disabled with a delay of max. 10µs to prevent destruction of the IC and high consumption of supply current I_S. If V_{C_L} >V_{C_Lmax} the transmitter output stages would be disabled immediately.

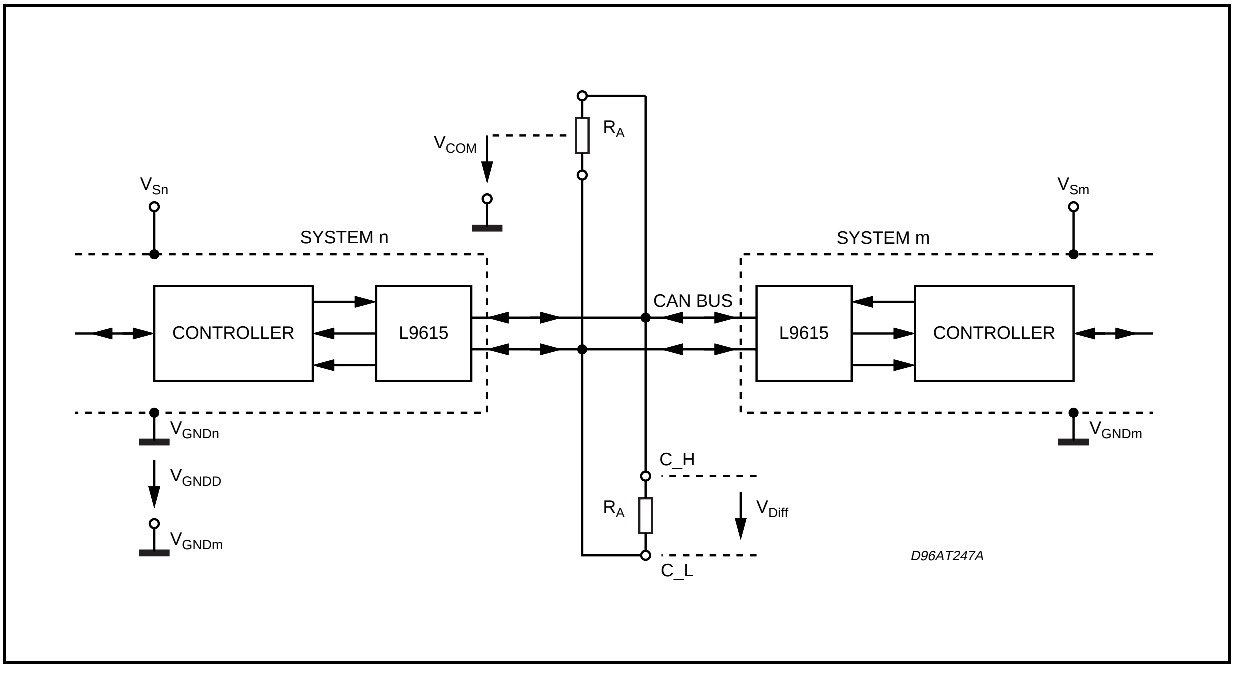
Pin ASC makes it possible to select two different modes of operation: High speed (≤1MEGABaud) and low speed (≤250kBaud).

The ASC pin is tied to GND for normal operation at ≤1MEGABaud. For slower speed operation at ≤250kBaud the rise and fall slope of the bus output can be decreased to reduce EMI by connectingg the ASC pin to V_S.

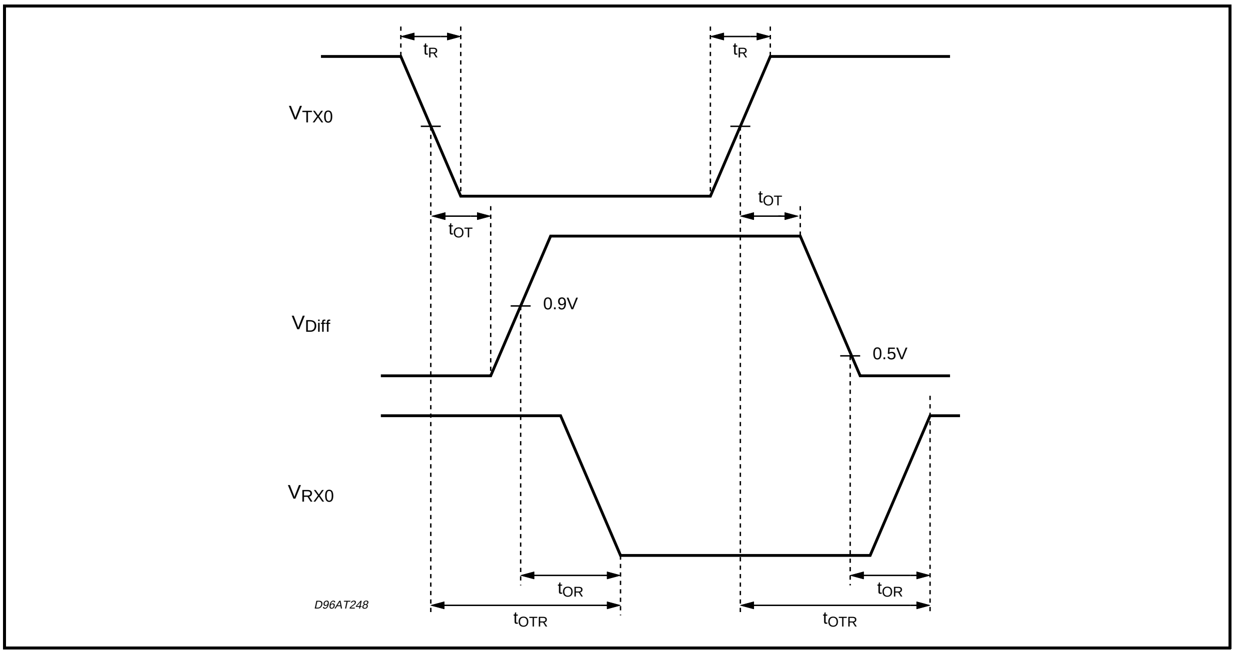
FUNCTIONAL TABLE

TXO	C_H	C_L	Bus State	RXO
L	H	L	Dominant	L
H or Floating	Floating $V_S/2$	Floating $V_S/2$	Recessive	H

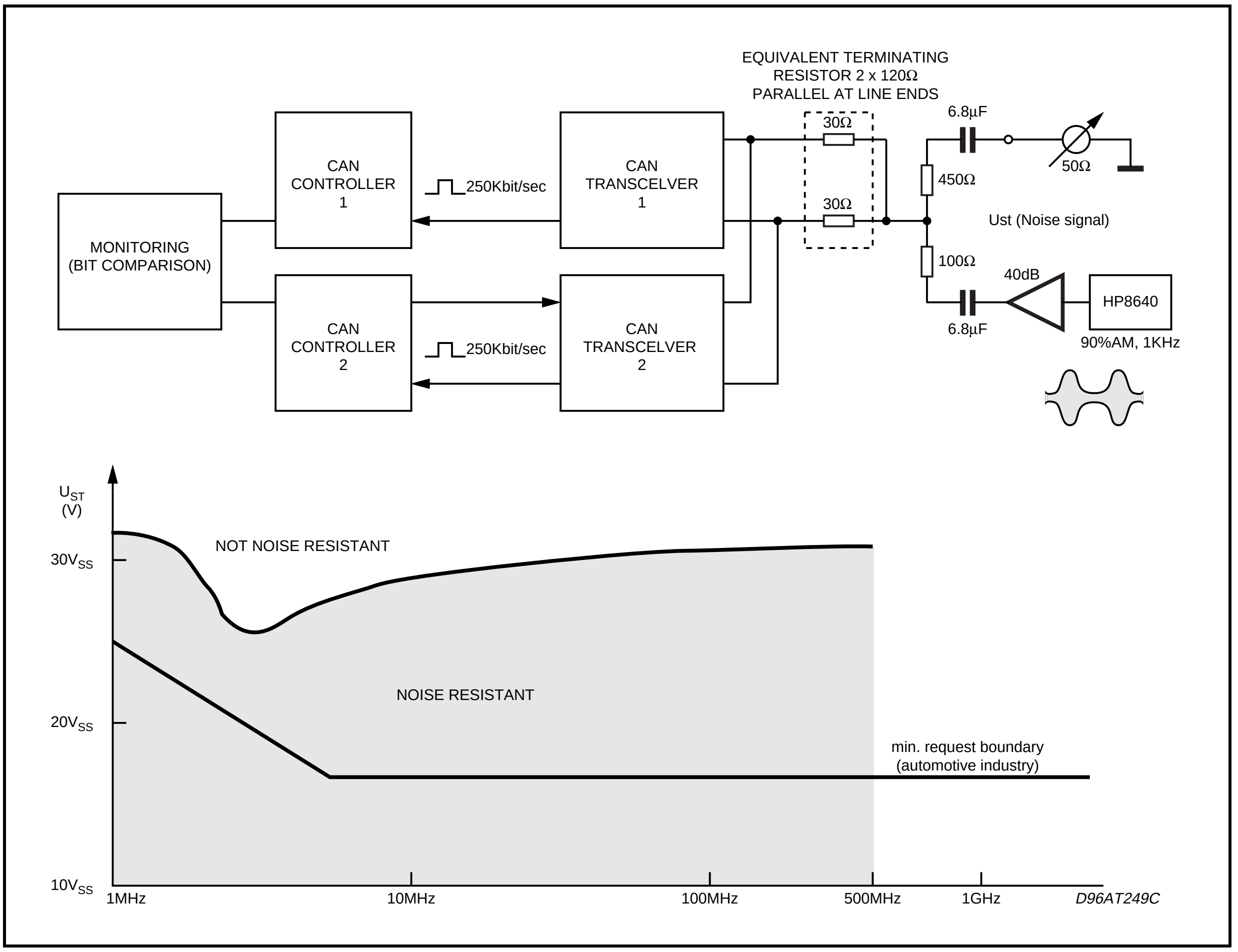
TYPICAL APPLICATION



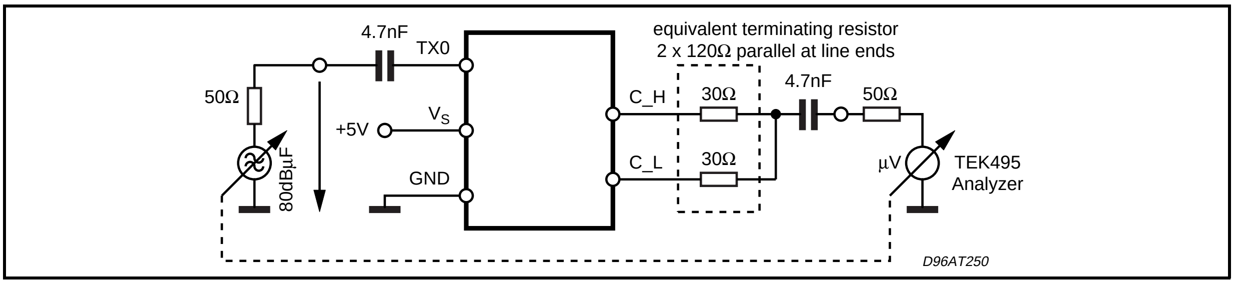
TIMING DIAGRAM



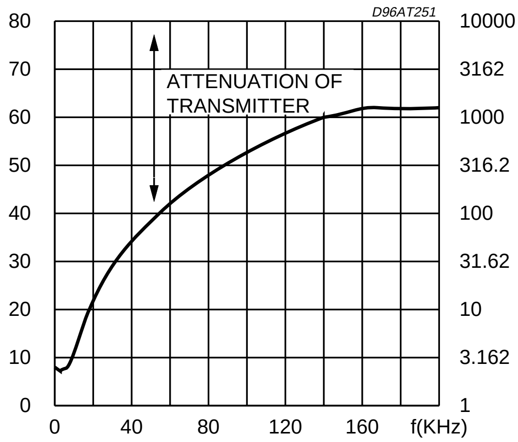
EMC PERFORMANCE (RECEIVER)



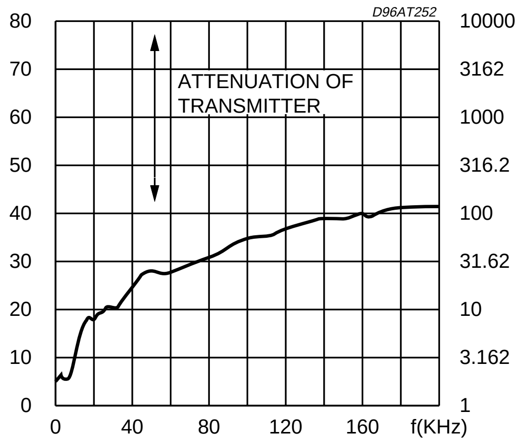
EMC PERFORMANCE (TRANSMITTER)



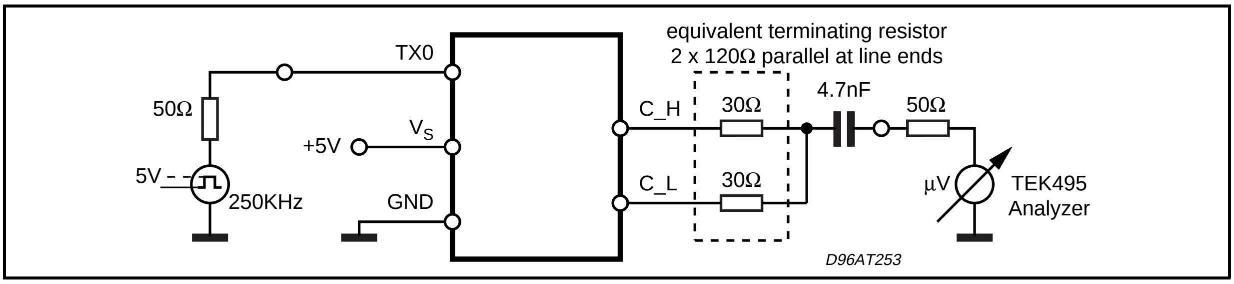
Transceiver Without Emc Reducing Measures



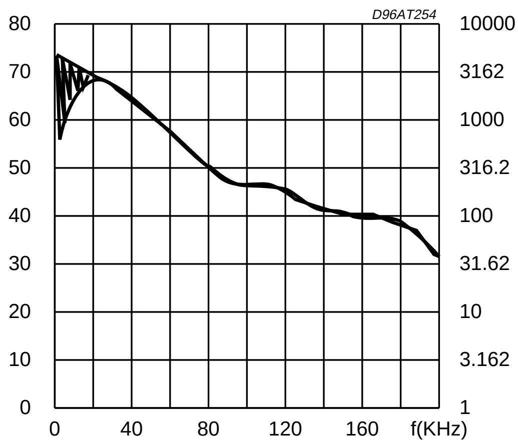
Transceiver With Emc Reducing Measures



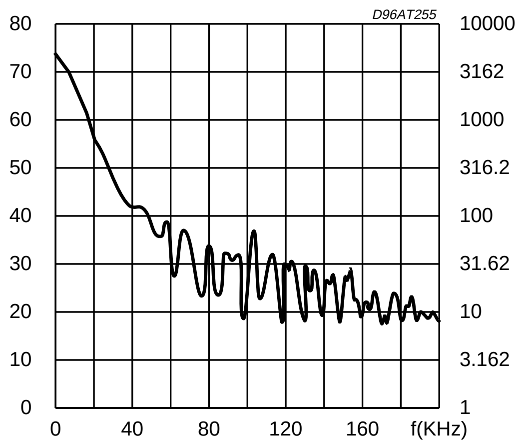
EMC PERFORMANCE (Transceiver Sending)



Transceiver Without Emc Reducing Measures



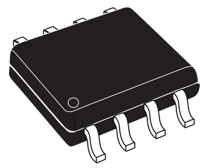
Transceiver With Emc Reducing Measures



DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A			1.75			0.069
a1	0.1		0.25	0.004		0.010
a2			1.65			0.065
a3	0.65		0.85	0.026		0.033
b	0.35		0.48	0.014		0.019
b1	0.19		0.25	0.007		0.010
C	0.25		0.5	0.010		0.020
c1	45° (typ.)					
D (1)	4.8		5.0	0.189		0.197
E	5.8		6.2	0.228		0.244
e		1.27			0.050	
e3		3.81			0.150	
F (1)	3.8		4.0	0.15		0.157
L	0.4		1.27	0.016		0.050
M			0.6			0.024
S	8° (max.)					

(1) D and F do not include mold flash or protrusions. Mold flash or potrusions shall not exceed 0.15mm (.006inch).

OUTLINE AND MECHANICAL DATA



SO8

